W. A. & E. H. LORENZ.

BRIQUETING MACHINE.

APPLICATION FILED AUG. 4, 1910.

1,023,433.

Patented Apr. 16, 1912.

3 SHEETS—SHEET 1.

Fig. 1.

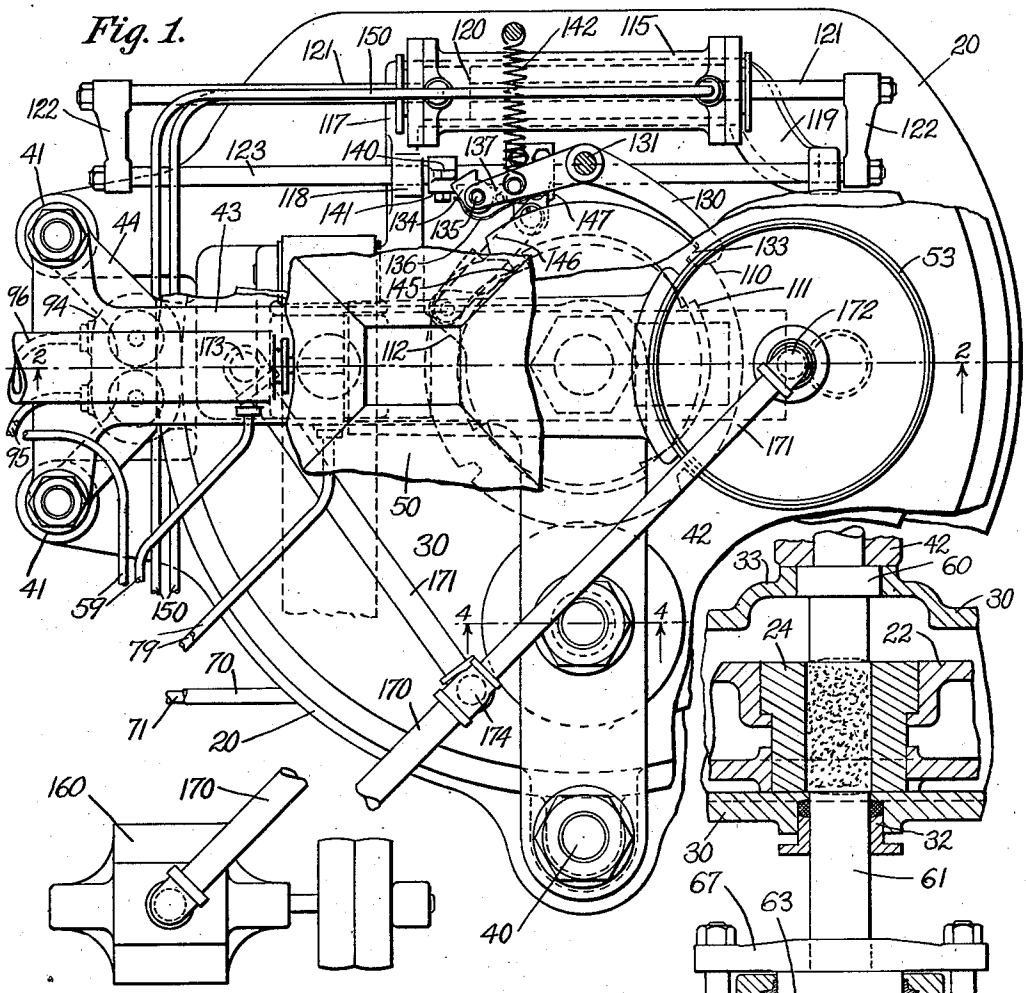
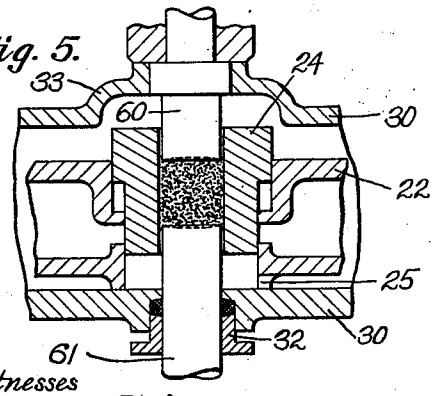


Fig. 4

Fig. 5.



Witnesses

K. E. Piler.

S. S. Grotta.

Inventors

William A. Lorenz.

Edward H. Lorenz.

by William A. Lorenz Att'y

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

W. A. & E. H. LORENZ.

BRIQUETING MACHINE.

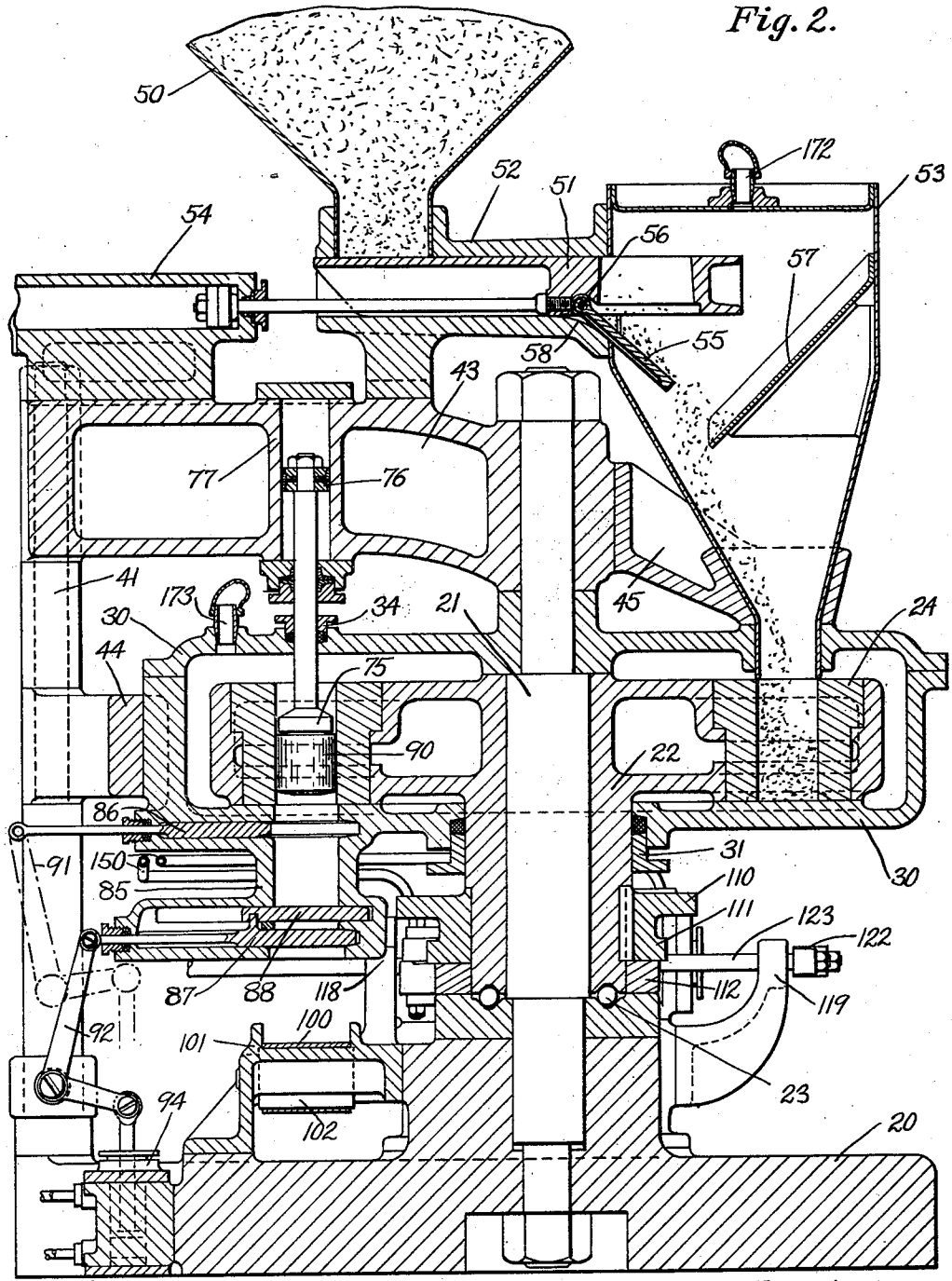
APPLICATION FILED AUG. 4, 1910.

1,023,433.

Patented Apr. 16, 1912.

3 SHEETS—SHEET 2.

Fig. 2.



Witnesses.

K. E. Seiler.

J. L. Grotta.

Inventors

William A. Lorenz.

Edward H. Lorenz.

by William A. Lorenz Att'y

W. A. & E. H. LORENZ.

BRIQUETING MACHINE.

APPLICATION FILED AUG. 4, 1910.

1,023,433.

Patented Apr. 16, 1912.

3 SHEETS—SHEET 3.

Fig. 3.

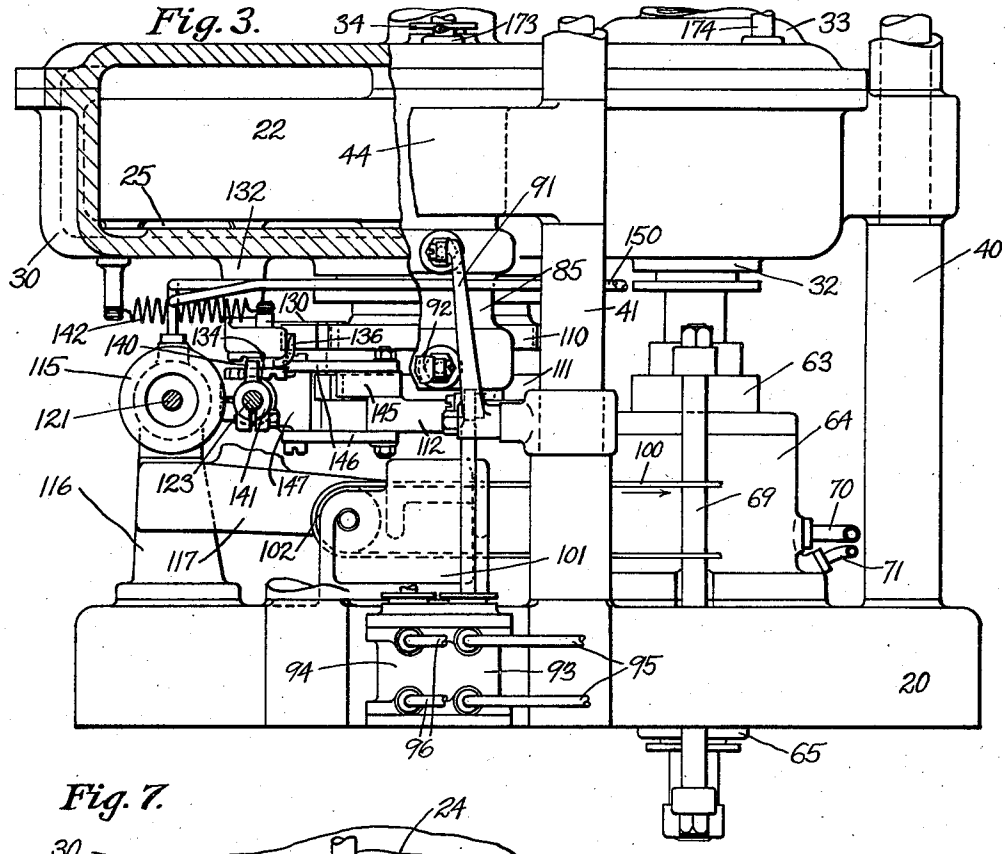


Fig. 7.

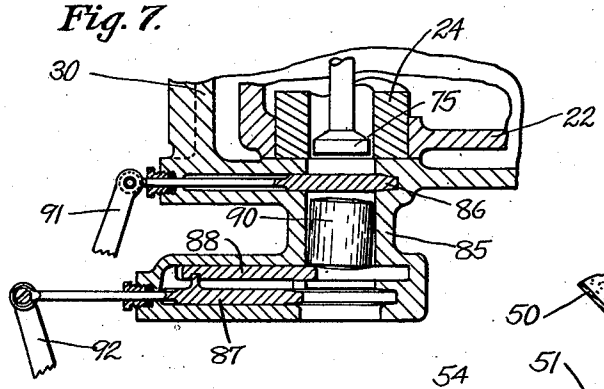
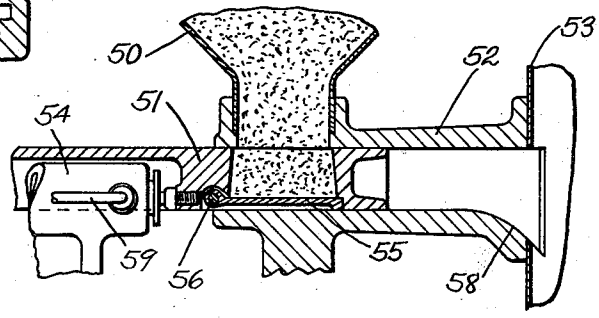


Fig. 6.



Witnesses.

K. E. Peiler.

S. L. Grotta

Inventors

William A. Lorenz.

Edward H. Lorenz.

by William A. Lorenz Att'y

UNITED STATES PATENT OFFICE.

WILLIAM A. LORENZ AND EDWARD H. LORENZ, OF HARTFORD, CONNECTICUT.

BRIQUETING-MACHINE.

1,023,433. Specification of Letters Patent. Patented Apr. 16, 1912.

Application filed August 4, 1910. Serial No. 575,602.

To all whom it may concern:

Be it known that we, WILLIAM A. LORENZ and EDWARD H. LORENZ, citizens of the United States, and residents of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Briqueting-Machines, of which the following is a full, clear, and exact specification.

Our invention is an improvement in machines for pressing and briqueting all kinds of loose materials and granular wastes, such as fine ores, flue dust, metal chips and shavings, sawdust, coal dust, etc. In the briqueting of such material, especially when no binding material is to be used, an important feature is the removal of air from between the particles. In order that the briquets shall be firm the particles must in some way cling together, and must therefore come into close contact, so that they either may become bound together through the engagement of their rough surfaces, or in some cases, and with very high pressure, even become plastic and flow together. In any case it is necessary to remove air from between the particles, so that this close contact will be attained. Furthermore air inclosed in the briquet will become very highly compressed, and when the forming pressure is removed, will have a very powerful disruptive tendency.

In the processes heretofore employed, either sufficient time has not been given to allow the air to escape properly, in that case forming rather loose and friable briquets, or the pressure has been applied very gradually and in special manners, so that the air may escape, rendering the operation comparatively slow. We therefore provide means whereby the air may be removed from the material previous to the pressing operation, so that this pressing operation shall not be rendered slow through the necessity of waiting for the air to escape. Furthermore, a more complete removal of the air may be thus attained.

In the drawings attached hereto, we have shown such a machine. It should be understood however, that we do not desire to confine ourselves to the exact construction shown therein, but will afterward particularly point out the broad features of our invention in the claims.

In the drawings, Figure 1 shows a plan view of our improved briqueting machine. Fig. 2 shows a section on the line 2—2 of Fig. 1, looking in the direction of the arrows. Fig. 3 shows an elevation looking from the left of Fig. 1, portions thereof being broken away. Fig. 4 shows a section on the line 4—4 of Fig. 1, looking in the direction of the arrows, showing the pressing mechanism. Fig. 5 shows the pressing mechanism in another position. Fig. 6 is a section of the charging mechanism in another position from that of Fig. 2. Fig. 7 shows the ejector air lock in another position from that in Fig. 2.

In this machine a base 20 supports a main column 21 and side columns 40 and 41—41. Mounted on the main column 21 so as to revolve about it, is a table 22 carried by ball bearings 23. This table is inclosed in an air-tight casing 30 which is supported on the main column 21 at the center and directly by column 40 at one side and by columns 41—41 through a bracket 44 at another point. Casing 30 is thus fixed and table 22 may revolve therein. The hub of table 22 passes out from casing 30 through a stuffing box 31, and carries below the casing indexing disks. Above casing 30 the columns are connected together by cross braces 42 and 43.

Table 22 carries a series of briqueting molds 24, four being shown in this instance, though of course a larger or smaller number may be used if desired. Molds 24 slide vertically in the table 22. In the operation of the machine these molds pass successively from one position to another, being filled with loose material at one point, this material being compressed to a briquet at a second stage, and the finished briquet being ejected at a third stage, the empty mold then being ready to begin the cycle again. This sequence of operations is generally used in such machinery, and forms no part of our invention. An aperture 25 is formed in table 22 to permit dirt to escape from beneath the molds as table 22 is turned.

The charging mechanism for bringing the loose material to the molds is as follows:—The supply of loose material is loaded into a hopper 50. Below this hopper a charger 51 slides air tight in a casing 52, being operated by a hydraulic cylinder 54. This casing 52 is supported at one end upon the brace 43. Casing 52 is further connected

with vacuum chamber 53. This chamber is large at the top and tapers below, forming a spout which leads to one of the molds 24. A baffle plate 57 is fixed within vacuum chamber 53 to break up to some extent the fall of loose material through that chamber. Charger 51 is provided with a loose bottom 55 hinged at 56. When the charger is being loaded from hopper 50, as is shown in Fig. 6, this loose bottom is closed and prevents the loose material contained in the charger from bearing on the bottom of casing 52. Charger 51 being thrust forward into chamber 53, as it nears the end of its stroke, the loose bottom 55 rides down on the curved end 58 of casing 52, so as to open that bottom and discharge the contents of the charger into chamber 53. In this way the bottom of casing 52 is protected from undue wear and tendency to leakage, from the contact of the necessarily rough particles of material. The loose material from charger 51 falling through chamber 53 is conducted into one of the molds 24, the charger being of such a size that its charge will properly fill the mold. Table 22 is then rotated a quarter turn by a mechanism to be later described, bringing the filled mold into the pressing position. Here (Fig. 4) the mold is between the fixed upper plunger 60, carried by brace 42, and a movable lower plunger 61. Mold 24 can also slide vertically in the table, so that the pressure at the two ends may be equalized. Lower plunger 61 is operated by hydraulic piston 63, operating in cylinder 64. A draw-back piston 65 operating in cylinder 66 and connected to piston 63 by yokes 67—68 and rods 69—69, is provided to withdraw plunger 61 after the pressing operation. Plungers 60 and 61 are made slightly smaller in diameter than the bore of molds 24, so as to allow any air which may still remain in the material to be expelled. The position of these parts when the compression is nearly completed, is shown in Fig. 5. Plunger 61 operates through a stuffing box 32 in casing 30, so that no air can enter casing 30 at that point.

The briquet being formed, and plunger 61 being withdrawn, and mold 24 having dropped to its position in the table, the table 22 is moved another quarter turn, bringing the mold to the ejecting position. It should be understood that during all the operations not only is a vacuum maintained in the chamber 53, but also in the interior of casing 30, all these being connected to a vacuum pump 160, Fig. 1, through pipes 170 and 171, connected to chamber 53 at 172, and to casing 30 at 173 and 174. As high a vacuum as possible is maintained continuously in the two vacuum chambers. If desired the exhaust from the chambers may be passed through some kind of dust collector before coming to pump 160.

At the ejecting point the briquet is ejected from the bottom of mold 24 by ejector 75, operated by piston 76 in hydraulic cylinder 77, mounted in brace 43. This ejector operates through a stuffing box 34 in casing 30. Ejector 75 forces the finished briquet out of the bottom of mold 24 into the air lock formed by casing 85, upper valve 86 and lower valve 87. These parts normally stand in the position shown in Fig. 2, the upper valve being open and the lower valve being closed. Lower valve 87 is also provided with a protecting plate 88, above it, upon which the finished briquet 90 falls when it is ejected from mold 24. Briquet 90 being ejected into casing 85 the upper valve 86 which is operated through bell crank lever 91 and hydraulic cylinder 93 is closed, and the lower valve 87 operated by hydraulic cylinder 94 through bell crank lever 92, the parts moving to the position shown in Fig. 7. It will be seen here that the protecting plate 88 extends a little ahead of valve 87, so that briquet 90 cannot drop out of casing 85, until valve 87 is entirely withdrawn. In this way there is no wear upon valve 87, due to sliding it under the rough briquet, and dirt cannot get into the valve seat for the same reason. From casing 85 the briquet drops upon a belt conveyer 100 supported at the point of impact by bracket 101. Of course other types of conveyer may be employed if desired, or the briquets may be removed in any other desired manner. After the briquet has dropped from casing 85 the valves are moved back to their normal position as shown in Fig. 2, ready to receive the next briquet. By the employment of this air lock, therefore, only a comparatively small amount of air can enter casing 30 at each operation thereof, and this will be immediately extracted through pump connection 173, and will not appreciably lower the vacuum in casing 30.

We have provided table turning mechanism for table 22, as follows:—On a hub of table 22 outside of the casing 30 are keyed locking disk 110 and ratchet disk 111. Below these the arm 112 revolves about the hub of table 22, but is not fixed thereto. Mounted on arm 112 is a pawl 145 which engages disk 111. Mounted on base 20 is bracket 116 carrying hydraulic cylinder 115. Bracket 116 is also connected by brace 117 to the central part of base 20, thus supporting cylinder 115 more firmly. Piston 120 operates in the cylinder 115 and carries the double-ended piston rod 121, which is connected by yokes 122 to the operating rod 123. The operating rod is supported in bearings 118 and 119. Latch 130 is pivoted at 131 to hub 132, fixed to casing 30. Latch 130 engages locking disk 110 with its toe 133, locking the molds at the proper points. On the other side of pivot 131, latch 130

carries dog 134, pivoted at 135. A spring 136 holds this dog in the position shown in Fig. 1, a toe 137 bearing against a pin, preventing the engaging surface of dog 134 from moving to the right. On rod 123 is mounted hub 141 carrying a finger 140. This finger engages the inclined surface of dog 134 when rod 123 moves to the right, and in so doing forces back dog 134 and lifts toe 133 from engagement with locking disk 110. At the same time pawl 145 which is connected to rod 123 through links 146 and hub 147, is brought forward into engagement with one of the notches of disk 111, coming into contact therewith as toe 133 has released disk 110. The continued movement of rod 123 therefore, will turn table 22. Meanwhile finger 140 passes by dog 134 and spring 142 brings the toe 133 upon the surface of disk 110. At the completion of a quarter turn this engages the next notch in disk 110, and properly locates the molds. When rod 123 is returned to the left, finger 140 turns dog 134 against the pressure of spring 136, so that latch 130 is not lifted, and when finger 140 reaches its position of rest, as is shown in Fig. 1, the toe of dog 134 can snap by finger 140 back into its normal position. The operation of these parts therefore, is entirely automatic, and can be controlled through the hydraulic connections of cylinder 115.

The operation of the machine as a whole is as follows:—The table 22 being locked in one position by latch 133, charger 51 is moved from the position of Fig. 6 to that of Fig. 2, dropping its load of material in a loose condition through vacuum chamber 53. The particles being well separated as they fall through this chamber, the air is rapidly extracted from therebetween, and on account of the proportionately large volume of the chamber the air contained in the charge will have only a slight effect upon the vacuum therein, and a high vacuum may be maintained, resulting in a very complete extraction of the air. The load of material falling into mold 24 fills that to the proper depth. Hydraulic cylinder 115 then being set in operation, the table 22 is turned one-quarter turn as hereinbefore described. Mold 24 being thus brought between the pressing plungers, these are set in action, and the briquet formed. During this formation, any air which may yet remain between the particles, will be forced out and the vacuum maintained inside of casing 30 aids in this final extraction. As, however, little or no air remains to be so forced out, the pressing operation may be done as rapidly as the power at hand will permit, and no time is lost waiting for the air to escape. The pressing operation being completed, table 22 is moved through another quarter turn, and the finished briquet ejected through the air lock as before described, and this cycle of operations is continued with each succeeding mold. The hydraulic connections operating the various parts of the machine may, if desired, be all led to one point, as is diagrammatically shown in Fig. 1, and there may be operated either by hand by separate valves, or if desired, by an automatic control apparatus, which shall operate these in their proper order. Any of the movements of this machine however, may be operated otherwise than by hydraulic power, if desired, and the nature of this power forms no part of our invention.

It will be seen therefore, that we have provided an apparatus whereby the removal of the air is facilitated to the highest degree, while the operation of the machine is not thereby rendered slow, but is on the contrary, greatly increased over that of the ordinary type. It is moreover a continuous operation, there being no intervals while inserting a new charge or pumping out the chambers.

It will of course, be apparent that many modifications might be made in this machine. Thus any other means might be adopted for moving the loose material through vacuum chamber 53, in order to effect the preliminary extraction of the air. Mechanical means for this purpose might be employed, and would have the advantage that the material might thereby be longer in the chamber, so that the extraction of the air might possibly be more complete. Many other ways of performing this part of the operation will readily suggest themselves to those skilled in the art. Other forms of charger such as perhaps a double bell and hopper, might be employed, or the charger might feed continuously, and the proper filling of the molds be accomplished by a device placed between chamber 53 and molds 54. Other forms of air locks for the removal of the finished briquet might also be readily devised. We do not desire, therefore, to limit ourselves to the exact construction shown herein.

We claim as our invention:—

1. In a briqueting machine, the combination of a vacuum chamber, a movable table containing a series of molds wholly inclosed therein, means for introducing loose material into said molds, and means for compressing it in said mold while still under said vacuum.

2. A machine for briqueting and pressing loose materials, comprising a vacuum chamber, means forming an air lock for introducing loose material into said vacuum chamber, a second vacuum chamber, a rotatable table carrying a series of molds inclosed therein, means for transferring loose material from said first vacuum chamber to said

molds, means for compressing said material into briquets in said molds, and means for maintaining a vacuum in said chambers.

3. A machine for pressing and briqueting loose and granular materials, comprising a vacuum chamber, a series of molds therein, means forming an air lock for introducing loose material into said chamber, means for passing such material in a loose and free state through said chamber and into said molds, means for compressing the material in said molds to form briquets, means to remove said finished briquets from said molds into said chamber, means forming an air lock for removing said finished briquets from said chamber, and means for maintaining a vacuum in said chamber, whereby the manufacture of said briquets may be carried on in said vacuum continuously.

4. A machine for pressing and briqueting substances, comprising a vacuum chamber, means for introducing material into said chamber, said means forming an air lock, whereby the vacuum in said chamber is not broken during the introduction of said material, means whereby the material is passed through said chamber in a loose and free state, whereby the air may be extracted from between the particles thereof, a series of molds, wholly contained in a vacuum chamber, to which said air-free material is transferred, means for compressing said loose material in said mold, means forming an air lock, means for removing said compressed material from said mold and transferring it to said air lock, whereby said compressed material may be removed from said chamber, and means for continuously maintaining a vacuum in said chamber.

5. In a pressing and briqueting machine, the combination of a vacuum chamber, a charger forming an air lock, a series of molds wholly contained in said chamber into which the material charged into said chamber falls, a press for briqueting the material contained in said mold, said molds and press being also contained in a vacuum chamber, an ejector for removing the finished briquets from said molds into said second chamber, an air lock by which the finished briquets may be removed from said second chamber, and means for maintaining a vacuum in said chambers.

6. In a briqueting machine, the combination of a vacuum chamber, means forming an air lock for the introduction of loose material into said vacuum chamber, a casing connected to said chamber, a table carrying a series of molds mounted to revolve in said casing and wholly incased therein, means for transferring the loose material from said chamber to said molds, means for pressing and briqueting the contents of said mold, an ejector for removing the finished briquets from said molds, an air lock through which said briquets are removed from said casing, and means for maintaining a vacuum in said chamber and said casing.

7. In a machine for pressing and briqueting loose materials, the combination of a feed hopper, a vacuum chamber, a charger sliding air-tight in a casing, and conveying successive charges of loose material from said hopper into said chamber, said charger having a loose bottom pivoted thereto which is closed during the movement of the charger in the casing, and opens automatically when the charger passes into the vacuum chamber, whereby the material charged is kept from sliding upon the casing during the movement of said charger.

8. In a pressing and briqueting machine, the combination of a vacuum chamber wherein the briqueting operation is carried on, and an air lock for the removal of the completed briquets therefrom, said air lock being provided with a gate valve having a protector plate mounted between the valve proper and the briquet, and operating with said valve, whereby the briquet is kept from contact with the gate during the operation thereof.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WILLIAM A. LORENZ.
EDWARD H. LORENZ.

Witnesses:
K. E. PEILER,
NELLIE PHOENIX.